TERRA Transportation Engineering and Road Research Alliance
Partnering for Roadway Innovation
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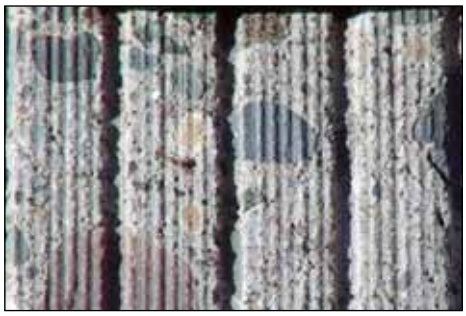
Quiet, Safe, and Smooth Concrete Pavements

As urban areas grow, more residents find themselves closer to well-traveled roads—and the noise that often accompanies the traffic on those roads. Increasing concerns about pavement noise from the public prompted researchers to explore quieter road surface options, resulting in the development of Next Generation Concrete Surface (NGCS), also known as innovative diamond grinding.

NGCS made history as the first new concrete pavement texture to be introduced in the last several decades and as the quietest texture yet developed for non-porous concrete pavements. NGCS provides a hybrid texture that resembles a combination of diamond grinding and longitudinal grooving. It produces a consistent surface without positive or upwardly spiked texture, which leads to a substantial reduction in sound.

NGCS uses conventional diamond-grinding equipment and blades, only with a slightly different head configuration, for both construction of new pavements or rehabilitation of existing pavements. A two-pass operation offers more control over the height and depth of the grooves and the uniformity of the surface configuration.



NGCS diamond-grinding surface at MnROAD

Diamond-grinding configurations at MnROAD

Research

In 2005, the American Concrete Pavement Association, the International Grooving and Grinding Association (IGGA), the Portland Cement Association, and the Institute for Safe, Quiet and Durable Highways at Purdue University researched various diamond-grinding configurations to develop a quieter concrete pavement surface. The following summaries highlight this research and subsequent efforts.

- ***Purdue University***—Purdue conducted research using its Tire Pavement Test Apparatus (TPTA), a 38,000-pound, 12-foot-diameter drum that allows testing of multiple pavement textures and compositions with a range of tire designs. Researchers evaluated existing diamond-grinding configurations, as well as new types of diamond-grinding configurations. They successfully developed and verified the innovative configuration.
- ***Pooled-fund project at MnROAD***—In 2007, a pooled fund-project with the Minnesota Department of Transportation, Texas Department of Transportation, Federal Highway Administration, and IGGA was undertaken to test field performance of the grind developed at Purdue on a real road. At the MnROAD pavement testing facility in Minnesota, diamond-grinding surfaces, which included a conventional grind and multiple variations of innovative grinds, were constructed and evaluated on a low-volume road and the I-94 mainline. Diamond Surfaces, Inc., donated grinding of the test cells to facilitate the research and advance the technology. The final configuration is the quietest pavement at the MnROAD facility, and it exhibits high friction properties comparable to surfaces in the network with acceptable friction levels.
- ***Deployment on high-volume roads in Minnesota and Illinois***—With the successful results at MnROAD, the next step involved constructing a full-lane-width test section on an in-service highway. In fall 2007, the first successful NGCS highway section was constructed on I-355 near Tinley Park, Illinois, on part of a new roadway. The second highway section was constructed in 2009 on I-94 near St. Cloud, the first full-width roadway construction and the first use of NGCS on existing pavement.

State-by-State

The use of NGCS is growing. A recent 2012 report identifies multiple NGCS surfaces in 10 states with diverse climates and pavements built with a variety of aggregates and mix designs. The following states have used NGCS:

- Arizona
- California (7 projects)
- Illinois
- Iowa (modified)
- Kansas
- Minnesota (5 projects)
- Oklahoma
- Virginia (2 projects)
- Washington (2 projects)
- Wisconsin (modified, city of Ormo)

Implementation

Minnesota also serves as the home to the largest NGCS project to date. In 2010, the Minnesota Department of Transportation (MnDOT) used NGCS on a one-mile stretch of I-35 near the heart of Duluth, Minnesota. The project received media attention, with local residents commenting positively about the quieter surface. MnDOT, the Concrete Paving Association of Minnesota, and the IGGA also hosted a live demonstration of construction and a tour of the Duluth project site.

Because of the recent development of NGCS, its current costs are slightly higher than conventional diamond grinding but less than other options. Those costs may be outweighed in situations where there is concern over noise, and in the future costs may decrease as use increases.

NGCS diamond grinding on I-35 in Duluth, Minnesota

Benefits

The results of NGCS research, testing, and implementation have demonstrated the following benefits:

- ***Decreased noise***—Absence of an upwardly spiked texture in NGCS has helped reduce tire and pavement noise by more than 75 percent in research studies.
- ***Improved ride***—Because NGCS produces a more level surface, it also provides a smoother, more uniform ride.
- ***Lasting and renewable***—With NGCS, the road maintains its texture longer, which helps increase its safety and longevity. It is also renewable, and the same treatment can be applied to the same surface again.
- ***Public satisfaction***—NGCS offers a way to address public concerns about noise, helping increase public satisfaction with the road construction process and improve the quality of life for residents.

Resources

The following reports and websites offer additional information about NGCS:

- *Development and Implementation of the Next Generation Concrete Surface* (American Concrete Pavement Association, 2012)
- *Innovative Diamond Grinding on MnROAD Cells 7, 8, 9 and 37* (Minnesota Department of Transportation Report# 2011-05, December 2010)
- *Influence of Pavement on Traffic Noise—Statistical Pass-By Measurements of Traffic on Several Interstate Pavements* (Minnesota Department of Transportation, 2011)
- "A Quiet Generation," *Roads & Bridges* (Vol. 49. No. 1, January 11, 2011)
- *Next Generation Concrete Surface* (IGGA fact sheet, February 2011)
- MnROAD project page for rehabilitating concrete pavement surfaces (TPF 5(134)) (www.dot.state.mn.us/mnroad/projects/PCC_Rehab/)
- Additional reports, references, and information about projects are available from the American Concrete Pavement Association website (www.acpa.org).
- Specifications are available from the IGGA website (www.igga.net).

Links to these resources are on the TERRA website at www.TerraRoadAlliance.org.

About TERRA

The Transportation Engineering and Road Research Alliance, or TERRA, brings together government, industry, and academia in a dynamic partnership to advance innovations in road engineering and construction, including issues related to cold climates. More about TERRA is online at www.TerraRoadAlliance.org.

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For More Information

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